

NOTES

CHRONOLOGY OF THE NATURAL RANGE EXPANSION OF *TILLANDSIA RECURVATA* (BROMELIACEAE) IN TEXAS¹—The expanding range of a native plant can indicate local or regional changes in the environment or changes in the dispersal of the species or both. The chronology of a range expansion may provide some insight into the complex interacting factors that allow a species to expand its range.

The present study describes the chronology of the range expansion (Fig. 1) of *Tillandsia recurvata* L., ball-moss, in Texas through 1977. *Tillandsia* species are specialized epiphytes or saxicoles. They are usually xerophytes and in the case of *T. recurvata* the plants are sensitive to freezing particularly when they are moist (Hagar 1990). Detailed considerations of historical phytogeography require an explicit knowledge of the historical range of the taxa. Fortunately, Birge (1911) mapped the known distribution of ball-moss in Texas. Although her map probably did not include all extant populations, it certainly reflected the general distribution of the species to 1910 when the work was completed. Literature and herbarium specimens from the early 1900s support the restriction of the plant to central Texas, an area having 50 to 75 cm of precipitation per year. Both Birge's map and herbarium specimens from the turn of the century show that the plant reached its eastern limits in Bell Co, central Milam Co., Lee Co. and further south in Lavaca Co. and northern Victoria Co. A similar range was defined by specimens cited by Smith (1944). The species was not listed for either Harris Co. or Brazos Co., two areas where it is common today and areas that were well known to botanists in 1911. In terms of longitude, the historical range of the species in Texas as mostly west of the meridian at 97 degrees and 45 minutes.

In 1942, *Tillandsia recurvata* was first collected (R.G. Reeves 1916, TAES) in Brazos County about 56 km east of its previously known range. The plant was very rare in the county (pers. comm., R.G. Reeves, John Sperry and Homer Blackhurst). In 1972, I was able to find the species in the county only at the Washington Church where Reeves had collected it in 1942. However, in subsequent years, various collectors observed the species at over 100 locations in the county. In 1964 *T. recurvata* was collected slightly east of the "Birge" line in Calhoun Co. (D.S. Correll 26171 (TEX)).

By 1989 *Tillandsia recurvata* had been recorded or collected from 18 counties in Texas east or slightly north of its range in 1911 as well from new locations in other states. The following Texas collections of *T. recurvata* are deposited in the

¹Technical publication 30871 from the Texas Agricultural Experiment Station.

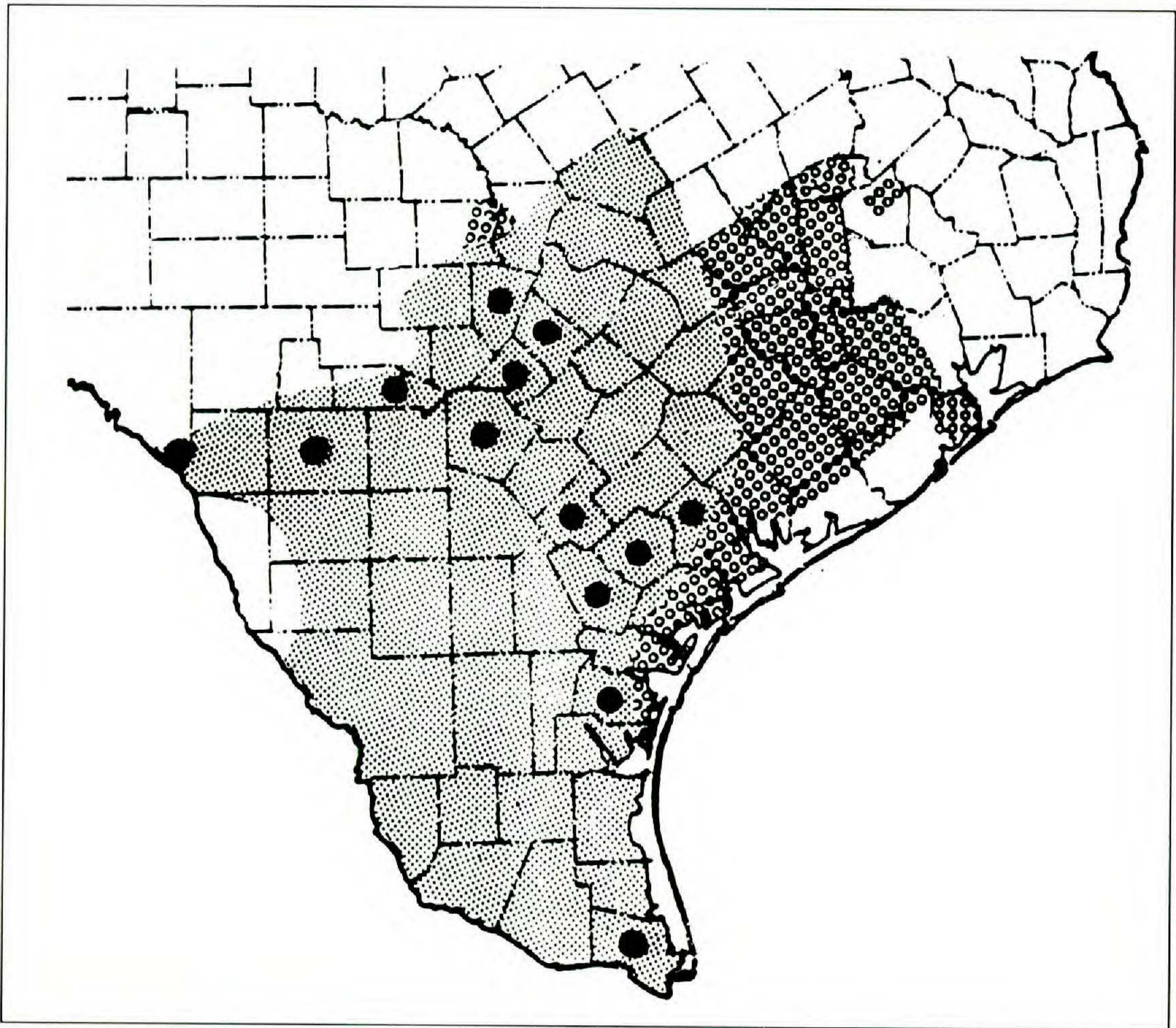


FIG. 1. Documented distribution of *Tillandsia recurvata* in South and South Central Texas: Grey shading: distribution in Birge (1911); Black dots: distribution in Smith (1948); Open circles: present distribution in natural (non-urban areas).

TAES Herbarium, except as noted, and collected outside the range defined by Birge in 1911:

TEXAS: **Aransas Co.:** *Sue Gardener* 603 (TAMU); **Austin Co.:** large populations found in rural areas of the county, *E.L. McWilliams* 1974-5; **Brazoria Co.:** *E.L. McWilliams*, photograph only; **Brazos Co.:** found throughout the highland areas of the county by 1977; **Burleson Co.:** *E.L. McWilliams* 1974-2; **Burnet Co.:** *E.L. McWilliams* 1977-11, 1977-12; **Fort Bend Co.:** *E.L. McWilliams* 1974-9; **Galveston Co.:** rare, *E.L. McWilliams* 1977-33; **Grimes Co.:** widespread, *E.L. McWilliams* 1977-1; **Harris Co.:** *E.L. McWilliams*, 1976-5; **Jackson Co.:** *E.L. McWilliams* 1977-18; **Llano Co.:** *Ellen Horlen s.n.*, 1977; **Matagorda Co.:** *E.L. McWilliams* 77-22; **Robertson Co.:** rural plants only seen in southern half of county, photograph only; **Waller Co.:** *E.L. McWilliams* 1977-25; **Walker Co.:** scattered in the Huntsville area, *John Meyer s.n.* (SHST); **Washington Co.:** common, *E.L. McWilliams* 1977-44; **Wharton Co.:** *E.L. McWilliams* 1977-24.

The northern geographical limits defined by Birge were studied in 1977 and specimens of the plant were found in southern but not northern Bell Co. as indicated by Birge in 1911.

These records indicate that the range of ball-moss has expanded along a wide band over 100 kms. eastward or northeastward between 1911 and 1977. Moreover, the species is currently found in many locations where it had not been encountered in 1972. However, as indicated by the herbarium specimen chronology, most of the expansion took place after 1942 and before 1978. One urban population was seen in Trinity Co. but no rural plants could be found in the eastern section of the county despite efforts by several collectors to locate new populations. The plants found in Trinity Co. were at least 5 years old, and the age of the plants did not indicate that the site had only recently been colonized. Thus, it appears that the new geographical range limits of *Tillandsia recurvata* stabilized in the 1980s.

The long distance dispersal of *Tillandsia recurvata* as a result of human activities is common in Texas and other states. The species has long been cultivated, is sometimes an epiphyte on woody landscape plants, and is sold as an oddity, and used in floral wreaths and other Christmas decorations. Cultivated populations of the species are not cited in this study. One example of long distance dispersal by man known to be of horticultural origin was a population on a single tree collected by Chris Hagar in 1988 near White Rock Lake in Dallas. Field observations and the large completely rural populations that occur in the counties listed here clearly indicate that natural wind dispersal is highly effective in dispersing the plant.

While the present distribution of *Tillandsia recurvata* has expanded significantly to the east and northeast, the present range differs little from the 1911 distribution in the northern part of its range. Two exceptions to this pattern are along the shores of Lake Buchanan in Burnet and Llano Cos. and the upper reaches of Lake Amistad in Val Verde Co. It is hypothesized that the lakes have modified the local mesoclimate and allowed the epiphyte to extend its range in trees and on rocks near the shores of the lakes.

In summary, county records for *Tillandsia recurvata* are reported for 18 counties in south central and east Texas east or northeast of where the species was known to occur in 1911. Populations of the plant have grown in size in previously marginal sites over the last 80 years. Changes in the geographical range of this epiphyte are potentially important since *Tillandsia* spp. are known to be sensitive to environmental changes in both moisture and minimum temperatures.

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ABOUT *LUPINUS CUMICOLA* (FABACEAE)—Isely (1990) combines *L. cumicola* Small with *L. diffusus* Nutt. stating that the former "represents peninsular Florida forms that have strongly ascending, foliose stems and sometimes broader leaves than the usual type." We point out that there are at least six consistent significant differences besides height which we present below.

Lupinus cumicola vs. Lupinus diffusus

- (1) Legumes (pods) mostly 27 – 42 mm long by 8.1 – 8.5 mm across* and broadly linear vs. mostly 35 – 47 mm by 6.3 – 7.6 mm and oblong.
- (2) No partitions between mature seeds vs. thin partitions between seeds.
- (3) Depressions on legume between seeds obscured by hairs vs. depressions evident.
- (4) Hairs on pods to ca. 3 mm long, rusty-tannish, and loose woolly vs. hairs to ca. 2 mm long, light brown, silky, and mostly somewhat appressed and parallel with each other.
- (5) Living plants silvery and to 1.9 m tall including inflorescences vs. grayish-green and to 0.7 m tall including inflorescences.
- (6) Principal stem of seedlings continuing erect growth for as much as 28 cm before developing ascending branches vs. only a short vertical growth before developing prominent prostrate branches that ascend only at ends.

*Note: Pods appear even larger as hairs are more spreading than in *Lupinus diffusus*.

Plants of both species occur near Winterhaven, Polk, Co., Florida and consistently exhibit these differences. We maintain that such differences warrant *Lupinus cumicola* being maintained at species level as is done by Small (1933). Our conclusions are based mostly on studies of 42 herbarium specimens (GA) of *L. diffusus* from Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina, 10 specimens (GA) of *L. cumicola* from Florida and abundant field observations in Florida, Georgia, and South Carolina, including ca. 20 popula-